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ABSTRACT

This study determined the specificity of cardiovascular endurance training on a bicycle ergometer. Eighteen male subjects were tested on a heart rate response test of 150 beats per minute on a bicycle ergometer at the pace of 50 revolutions per minute (rpm) and at 160 beats per minute at 60 and 80 rpm, with the resistance equal to the force of gravity of three kilograms. The subjects were then randomly divided into three training groups, each group to train at one of three initial testing paces. All three groups significantly improved performance on all three performance tests to the .01 level of confidence. No significant differences were found among the groups on any of three performance tests. It was concluded that, within the limitations of this study, pace training appears to be general rather than specific with regard to cardiovascular endurance training. (Authors/JA)

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SPECIFICITY OF CARDIOVASCULAR ENDURANCE TRAINING

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INTRODUCTION

The question of whether motor skill performance training is general or specific is still not clearly solved, but it is generally recognized that motor performance and learning is task specific. For the area of endurance training, however, little is known of the specificity versus generality issue. Is endurance training specific or general? Can an individual train at a particular pace to specifically improve at that pace, or will training at another pace be as effective?

It is generally accepted that cardiovascular endurance is best improved by performing work. This improvement usually correlates fairly high and positive with the total amount of work during training. The work can be performed at various paces, either continuously or intervally. Many studies have been performed comparing interval and continuous training. Also, several studies exist regarding the intensity of the work. These studies often use maximum oxygen consumption as one criteria of cardiovascular endurance and various performance tests as other criteria. Whereas maximum oxygen consumption is usually recognized as the best test of cardiovascular endurance, the validity of the performance tests can be questioned because the test may be specific to one of the training methods.

STATEMENT OF THE PROBLEM

With total mechanical work held constant, will three methods of pace training significantly and specifically improve cardiovascular endurance as measured by performance tests specific to each training method?

PURPOSE

The purpose of this study was to compare the effectiveness of three various pace methods of training on a performance test specific to each group. More

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specifically, an attempt was made to:

1. Hold total mechanical work constant and train three groups of subjects for seven weeks on a Quinton-Monark bicycle ergometer at the following paces with the resistance equal to the force of gravity on three kilograms.
2. Test each group on a heart rate response test of 150 at fifty revolutions per minute, and 160 at sixty and eight revolutions per minute with the resistance equal to the force of gravity on three kilograms.

PROCEDURE

The subjects for this study were eighteen volunteer male students at Washington University, Saint Louis, Missouri. The mean age of the subjects was 22 years and the mean weight was 158 pounds. All subjects were asked not to engage in any other cardiovascular training during the seven week program.

TESTING PROCEDURE

Each subject was given three tests. One at fifty revolutions per minute with a resistance of the force of gravity on three kilograms; another at sixty revolutions per minute with a resistance of the force of gravity on three kilograms, and the other at eighty revolutions per minute with a resistance of the force of gravity on three kilograms. The scores on the tests were the time for the subject's heart to reach a rate of one hundred sixty beats per minute. A rate of one hundred fifty beats per minute was used for the fifty revolutions per minute test. The heart rate was counted by the investigator by the use of a stethoscope and a stopwatch and was calculated by converting the time required for thirty heart beats to a beat per minute rate by use of a conversion chart. The heart rate was calculated by this method every thirty seconds during testing. The stopwatch was started with the first of the thirty beats and stopped on the thirty-first beat. The exact score was calculated by interpolating the difference

between the heart rate below one hundred sixty and above one hundred sixty for the time involved (thirty seconds). The subjects were not allowed to warm up on the ergometer for testing or training. The subjects were informed of their heart rate and time during the tests. One test was given each day with one day between tests. The tests were rotated on an individual basis to negate learning or training effect. The tests were repeated at the end of the training period using the same procedure.

TRAINING PROCEDURE

Each subject was randomly placed into one of three groups for testing purposes prior to training. Three days per week were chosen for the subjects so that no three successive training sessions were on consecutive days. Group I trained initially at fifty revolutions per minute with a resistance equal to the force of gravity on two kilograms for nine minutes and thirty-six seconds. Group II trained initially at sixty revolutions per minute with a resistance equal to the force of gravity on two kilograms for eight minutes. Group III trained at eight revolutions per minute with a resistance equal to the force of gravity on two kilograms for six minutes. This workload was gradually increased until Group I worked for tweleve minutes and forty-eight seconds; Group II worked for ten minutes and thirty-six seconds; and Group III worked for eight minutes with the resistance equal to the force of gravity on three kilograms. All subjects performed an equal amount of work per training session.

If a subject could not finish his assigned workload, he rested until he could finish in that same session. A subject was dropped from the study if he missed more than two training sessions. However, missed sessions could be rescheduled.

RESULTS

Three statistical techniques were utilized in this study to determine whether three pace variations of endurance training are general or specific. The difference method, a t-test for significance of the difference between correlated

means, was used to compute the significance of the gains made by each group on each test. Analysis of covariance was used to compute any differences which existed among the groups on each test. Orthogonal comparisons were then used to calculate the nature of these differences.

The findings of this study were as follows:

1. All three groups significantly improved performance on all three performance tests to the .01 level of confidence.
2. No significant differences were found among the groups on any of the three performance tests.

DISCUSSION

One of the limitations to this study was the number of subjects available for the final testing. A number of subjects were eliminated because of illness and because many were doing cardiovascular training outside of the study. While the nature of analysis of covariance makes it very difficult for differences to be significant among small samples, there appeared to be a trend to the possibility of specificity of endurance training.

It would also be interesting to attempt a study of this nature and physiologically equate the work rather than mechanically equate the work.

CONCLUSION

Within the limitations of this study, the following conclusion appears to be justified:

1. Pace training on a bicycle ergometer three days a week for seven weeks is effective in improving cardiovascular endurance.
2. Pace training on a bicycle ergometer appears to be general rather than specific with regard to cardiovascular endurance training.